AMERICAN ASSOCIATION.

NINETEENTH MEETING OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, HELD AT TROY, N. Y., AUGUST 17TH–24TH. 1870. [*Abstracts of papers continued from the October Number.*]

Mr. W. H. DALL gave a short account of some researches into the structure of the Eskimo languages in which he was engaged. He showed how the radical words of the different dialects from Greenland to Bering Strait were essentially the same, while many of the adjectives, verbs and prepositional terminations differed in tribes which were closely adjacent. He then gave a description of the multiform changes of the termination of the verbs, showing that the Eskimo of Repulse Bay had, in the indicative mood of a transitive verb, five forms, only one of which (the present) had an exact equivalent in English. They were the present form or tense; the past imperfect, indicating an action just performed; the past perfect, indicating an action performed long ago; the future, relating to an action about to be performed; and the future perfect, which denoted an action to be performed in some future time.

The termination changing with the singular, dual and plural numbers, and the various cases of subject and object, result in a total number of seventy-eight affirmative terminations for the present tense, in a transitive verb, all different; the whole number of different terminations in the indicative mood is eleven hundred and ninety, and of the whole verb is over three thousand one hundred, including the affirmative, negative, and interrogative forms. The non-transitive verbs have a smaller number. The verbs "to be" and "to have" are identical and possess very few forms.

Mr. DALL also gave an account of the anatomical characters of the conical univalve mollusks generally known as Limpets. These have been divided by Gray and other naturalists into two orders, according as the animal possessed one plume shaped gill over the back of the neck, or a cordon of lamellar gills all around the body. His recent investigation of the anatomy of many species, principally from the American coasts, had shown that the value of these distinctions was less than had been heretofore supposed. Some of the Limpets were shown to be entirely without special gills; others possessed a cervical plume-like gill, and also a cordon of accessory gills, greatly varying in extent in the different genera. For this reason he proposed to include them all in one order (named *Docoglossa* by Dr. Troschel) subdividing it into two sections characterized by the total absence, or by the presence, of gills. These suborders would respectively bear the names of *Abranchiata*, and *Proteo-branchiata*. The

Solenoconchæ and *Polyplacophora*, included by Troschel in this order, were to be eliminated; the former having the value of a subclass, while the latter form a well marked order. He concluded with some remarks on the synonymy of some of the genera most abundantly represented on our coasts.

Mr. THOMAS MEEHAN read a paper on "Nutrition and Sex in Plants." He referred to his "laws of sex," read last year, and now proposed to show that a decreased power of nutrition was one of the operating causes against that high state of vitality necessary to produce the female sex. He stated that there were two classes of male flowers on the common Chestnut (*Castanea Americana*), one from the axils of leaves on weak branches, the other terminating the vigorous shoots, only on which the female flowers are formed. The axillary male flowers mostly matured before the supra-pistillate ones opened. These were extremely weak, owing to the superior absorptive power of the females below them. He then exhibited some specimens of these, as well as some from a very large Chestnut tree, which had always borne abundant fruit, but had this year produced nothing but male flowers. The leaves were all striped with yellow and green, indicating, as every experienced gardener knows, that nutrition was obstructed. Plants over watered, by which the young feeding roots rotted, always put on this yellow cast. The yellow tint always followed "ringing" the branches, or any accident done to the bark. The influence of this *defective power of nutrition*, in this instance, he held so clear that he had no difficulty in concluding that it was *one of the agents which operated on the laws of vitality that governed the sexes.*

Prof. E. D. COPE of Philadelphia, read a paper on the "Reptilia of the Triassic Formation of the United States." He stated briefly the distribution of the rocks of Triassic age, and the localities at which vertebrate remains have been found. He stated that fourteen supposed species had been named, which had not been referred to their appropriate ordinal groups. He then pointed out that three of the genera, — Megadactylus of Hitchcock, Clepsysaurus of Lea, and Bathygnathus of Leidy, belonged to the order Dinosauria. This he had been unable to determine from the vertebræ, or even the limb bones, but from the pelvic elements. The structure of these in the first two genera was described and represented as a pair of coössified styles upon which the animal supported himself when in a sitting position. The fore limbs of the Megadactylus were rather long. The genus Clepsysaurus was, as Lea has pointed out, nearly related to Palæosaurus of the Bristol (England) conglomerate, while Bathygnathus was also related to the same and to Teratosaurus. Of the eleven species remaining, nine had been found by Prof. Cope to belong to the Thecodontia, and to be allied to the genus Belodon. He reduced the number of definable forms to four, stating that the remaining five were mostly established on the posterior teeth of the others. His fourth species he regarded as undescribed. It was the largest of the species, and was established on remains from Phœnixville, Penn., discovered by

Charles M. Wheatley. A portion of these was exhibited. They included bones of the extremities, pelvis, and vertebræ. The femora measured about thirteen inches in length. It was named *Belodon lepturus*.

The question of the greater or less generalization of types in the earlier ages was discussed, and evidence deduced from the Reptilia of the American Trias that such was the case. Thus there was much greater difficulty in distinguishing the Crocodiles and Dinosauria of the Trias, than those of the Cretaceous. This was to be especially seen in the forms of the vertebræ, and the femora. The Rhynchocephalia and Thecodontia were Triassic groups still more generalized and intercalated between the preceding and the later orders Lacertilia and Crocodilia. In the case of the former this was shown in the structure of the cranium and vertebræ; in the latter in the same regions, in the sacrum, in the extension of the rib-series to the latter, and in the limbs. The speaker explained that the structure of the quadrate region precluded the reference of the Triassic and Permian genera Parasaurus, Hyperodapedon, Telerpeton, Protorosaurus, etc., to the Lacertilia, as had been done by Huxley, but that they were truly Rhynchocephalia, an order represented by but one recent genus. He stated that he knew of no Lacertilian older than the Jurassic period.

Professor JAMES HALL read a paper "On the Relations of the Oneonta Sandstone and Montrose Sandstone of Vanuxem with the Hamilton and Chemung Groups." The object of this paper was mainly to correct some erroneous impressions regarding the geology of Eastern New York.

The sandstone referred to had been termed in the annual reports of Mr. Vanuxem the Montrose sandstone and Oneonta sandstone; the former a well marked locality in Pennsylvania; the latter in New York. This sandstone had been regarded as the terminal rock of the series, and as lying above the rocks of the Chemung group. The same views were entertained by Mr. Mather, who parallelized the sandstone of the upper part of the Catskill Mountains, with that of Montrose and Oneonta, giving a section from near the base to the top of the Catskill, without recognizing any important subdivisions.

In the final nomenclature the term Catskill group was adopted for the entire series. A red sandstone, which had been observed farther to the westward, along the Tioga River and upon the borders of New York and Pennsylvania, containing sales and bones of Holoptychius was regarded as part of the same group. Since this red sandstone of Tioga was known to thin out to the westward, it gave support to the hypothesis that it was only the thinning western extension of the formation which was so largely developed in the Catskill Mountains.

In the central and western parts of the State the limits of the Hamilton, Portage and Chemung groups, had been pretty well defined, the two latter occupying a great breadth in the southern counties. In the coloring of the map the great breadth given to the Catskill group in the eastern counties reduced the Chemung and Portage to a narrow belt giving an incon-

gruous aspect to the area, especially when we recognize the generally accepted view, that the source of the sediments has been to the eastward of these limits.

A few years after the close of the survey it was ascertained that in Delaware county, lying above the sandstones of Oneonta, there were several hundred feet of gray greenish and other sandstones and shales, containing the characteristic fossils of the Chemung group.

At the same time it was ascertained that the beds below the Oneonta sandstone in Schoharie and Otsego counties contained no characteristic Chemung fossils. The sediments it is true were found to be coarser than those of the Hamilton group in the central and western parts of the state, and contained the remains of land plants, but otherwise embracing the common characteristic species of that group. Waiting opportunities for farther investigation the results of these observations were not published, though the error has been partially corrected in the geological map published by the Geological Survey of Canada.

Later observations have served to verify the earlier conclusions, but there has been no opportunity of tracing out in a complete and satisfactory manner the limit of this sandstone formation.

An examination of the Hamilton group along the valley of the Schoharie creek, has shown that the more argillaceous deposits, with marine fossils, are succeeded by coarser beds with remains of land plants, and in the neighborhood of Gilboa numerous trunks of large tree-like plants have been found standing in the position in which they had grown. The entire thickness of the formation is not less than three thousand feet, and this is succeeded by the red and gray sandstone and shales originally described as the Oneonta and Montrose sandstones.

The entire thickness of this sandstone in Schoharie and Delaware counties has not been ascertained, but in the adjacent county of Otsego it is not less than five hundred feet, and is characterized by the diagonal lamination especially in the gray beds, and many of the layers contain remains of land plants.

The characteristic fossil Cypricardites* of Vanuxem is found in a shaly bed at the base of the sandstones in Richmond's quarry near Mt. Upton, immediately above a plant bed which, so far as at present determined, belongs to the upper part of the Hamilton group.

This sandstone so far as observed, rarely contains remains of fishes, and among them scales of Holoptychius, but all those seen had proved of distinct species from those of the Tioga red sandstone.

Lying to the south and above the sandstones we have the series of beds before referred to, containing the characteristic fossils of the Chemung group, and above this the sandstone and conglomerate of the top of the Catskill mountains.

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*The two species *C. Catskillensis* and *C. angusta* are both varieties of form due to pressure. The shell, however, is not a true Cyprycardites.

The parallelism of the groups in the eastern and western parts of the State may be thus presented: —

Old Red Sandstone of Tioga, etc	Catskill Mt. Sandstone,
Chemung Group,	Chemung Group,
Portage Group,	Oneonta Sandstone,
Hamilton Group,	Hamilton Group.

In the central part of the State there is no sandstone bearing the character of the Oneonta sandstone; on the contrary, the Hamilton group is succeeded by a series of shales, flagstones and heavy-bedded argillaceous sandstones constituting the Portage group. These two formations hold the same relative position to the Hamilton group below and the Chemung group above. The western extension of the Oneonta sandstone has not been traced beyond Chenango county, but it seems probable that we shall find a gradual diminution in the coarser material, a coming in of argillaceous matter, and the absence of the evidence of cross currents producing diagonal laminations, leaving the deposits of the same epoch to be spread out evenly over the ocean bed.

We are not yet quite prepared to assert that the Oneonta sandstone of Eastern New York is the precise equivalent of the Portage group. The former, being the deposits of stronger currents, may have preceded or followed the epoch of the slates and flagstones of the Portage as seen on the Genesee valley. It will be only after a careful examination of the Oneonta and Montrose sandstones that we can speak with certainty of its relations to the Portage, but we are prepared to show that it has no near relation in time to the red rocks of the summit of the Catskill Mountains, nor to the red sandstones with remains of Holoptychius, which occurs along the Tioga and upon the borders of Steuben and Alleghany counties of the State of New York.

Mr. J. B. PERRY made a communication on "Boulder-trains in Berkshire county, Massachusetts." In Richmond, Berkshire county, Mass., there are six or seven nearly parallel trains of angular boulders, two of them particularly well defined. Attention was called to them years ago by Dr. Reid of Pittsfield. They have been also referred to, and in part described by Sir Charles Lyell, and the late President Hitchcock.

These trains originate partly in a range of hills consisting of chloritic slate, in Canaan, Columbia county, N. Y., but more especially in two other nearly parallel ranges of hills with a meridional trend near the State line in Richmond, Mass. The latter ranges consist of a greenish slate occasionally interstratified with beds of limestone. For the most part the boulders can be readily traced back to their exact source. Some of the trains may be followed south-easterly for four or five miles; others, passing over the Lenox range of hills, can be traced for ten or fifteen, and one of the larger for some twenty miles. Their direction during the first part of their course is south about 55° east. Somewhat farther on, they change their trend, it being some 35° east of south.

President Hitchcock presuming that there was a submergence of the

region, speaks of these lines of boulders as *osars*. Sir Charles Lyell also supposing a depression, thinks these boulders were transported by coast-ice.

There being no evidence of any considerable depression of this part of the continent during the Glacial Period, even if a submergence would afford an adequate explanation, which it does not, how are we to account for these boulder-trains?

As the vast ice-sheet which spread over the country gradually wasted, the elevations from which these boulders were derived would be at last laid bare. The ice no longer passing directly over the tops of the hills, there is evidence that the mass was parted, moving around the north-eastern and south-western sides of the several peaks. Of course, under these circumstances, the hillsides would be pressed and rubbed, blocks of slate and limestone detached from their places, and borne along upon the surface of the ice-sheet. This being at that time about six hundred feet in thickness, and continuing to thaw, the boulders would be carried forward for some distance, and finally left above the typical drift, as we now find them. As the ice wasted there would be changes in the direction of the moving mass, determined by the character of the underlying surface of solid rock, thus enabling us to account for the variation in the course of the boulder-trains.

Such, in brief, is the explanation suggested for these trains of angular rocks, and for some other similar phenomena in different parts of New England — an explanation in entire consonance with all the known facts connected with the glaciation of the country, and requiring no arbitrary resort to the theory of submergence.

Professor ORTON presented a paper "On the Evidence of a Glacial Epoch at the Equator," which controverted Professor Agassiz's theory of the glacial origin of the Amazon Valley. He briefly reviewed the statements made by Professor Agassiz that the Amazon formation did not contain a single marine fossil, and therefore was the product of an immense glacier that slid down from the Andes to the Atlantic. Professor Orton however, in his expedition across the continent, discovered an immense fossiliferous deposit at Pebas on the Maranon, and subsequent researches, carried on under his direction by Mr. Hauxwell, had resulted in the discovery of several other localities abounding in tertiary shells. A series of these were exhibited to the Association and excited considerable interest, not only from the novelty of their forms, but also from the fact that they were found in the heart of the great valley where Agassiz declared there were none. The shells are of fresh or brackish water types, and plainly indicate that the Valley of the Amazon, like the Pampas of La Plata as shown by Darwin, is an estuary creation, or the relic of a vast Mediterranean of fresh-water. In the minds of geologists present, these fossils settled the question of the origin of the valley; it was illogical and absurd to assume a glacial winter within the tropics when we do not discover one solitary sign of its presence, —striæ and boulders are

not visible, and in their stead extinct shells are abundant. Professor Agassiz has declared that the Amazon clays are "drift" from the Andes transported by glaciers and ground down to an impalpable powder. But these fossils, some of them very delicate, are marvelously well preserved. Two explanations of the existence of these fossils have been given: (1) That they are accidental, being fragments of some formation elsewhere, mingled with the drift. But this hypothetical formation cannot be found. The valley is bordered by either palæozoic or cretaceous rocks. Besides, the fossils are *in situ* and identified with the peculiar Amazonian variegated clays. They must have lived and died in the vicinity of the spot where they are now found. (2) That the beds in which they are found may overlie the drift like the marine clay beds of Champlain. But the fossils are plainly of the same age as the formation in question, and cannot be later than the Pliocene. Moreover, the terraces which would result from submergence are not discernible within or on the borders of the valley.

Professor Orton then alluded to the glacial transmigration hypothesis, and showed by a comparison of the flora of the United States, and that of Andean highlands, that there had been no mingling of plants such as would have resulted had a vast glacier covered the whole or even the greater part of North America. And the conclusion reached was that facts were incompatible with the existence of an equatorial glacier and even of an intertropical cold epoch.*

Mr. R. W. RAYMOND, United States Commissioner of Mining, gave a description of certain typical physico-geological phenomena of the Pacific slope. The speaker, to save the time of the meeting, condensed into one rapid talk the substance of his two papers on "The Lava-ducts of Washington Territory," and "The Great Salt Marsh of Silver Peak, Southern Nevada." The former, he said, was a picture from the heart of the great volcanic overflows of the North, and the latter an equally characteristic scene from the region of solfataric and thermal-aqueous metamorphosis in the South. The accumulation of ice in the subterranean lava-ducts, the disappearance in them of streams ("lost rivers"), and various other features were briefly alluded to. The speaker ascribed the alkaline deposits of the Nevada basin to the decomposition of the soda-felspar abounding in the rocks, by means of hot gases and waters, and the subsequent percolation of these into the valleys.

Professor C. H. HITCHCOCK presented a paper upon "The Geology and Topography of the White Mountains." The topographical results were embodied in a model which he exhibited — a raised model on the scale of three-fourths of an inch to one thousand feet. This model is about four

*The fossils above referred were given to Mr. Conrad for identification. He distinguishes seventeen different species—all extinct, belonging to nine genera, of which only three are now represented. The species are *Isaca Ortoni*, *I. lintea*, *Liris laqueata*, *Ebora crassilabra*, *E. bella*, *Hemisinus sulcatus*, *Dyris gracilis*, *Neritina Ortoni*, *Bulimus linteus*, *Pachydon* (*Anisothyris*) *tenuis*, *P. carinatus*, *P. obliquus*, *P. erectus*, *P. cuneatus*, *P. ovatus*, *P. altus*, and a bivalve allied to *Mulleria*. Duplicates of these singular forms can be obtained of Professor Orton.

feet long, and shows the territory bounded by the Ellis, Saco and Peabody rivers. It is colored to show the distribution of the several formations. These are (1) several varieties of gneiss, called the White Mountain series; (2) granite; (3) eruptive granites and traps; (4) Staurolite and andalusite rocks belonging to the Coös group. The first group composed the main range of mountains in order from north to south, namely: Madison, Adams, Jefferson, Clay, Washington, Monroe, Franklin, Pleasant, Clinton, Jackson and Webster. Contrary to previously received opinions, it was said that the structure of this ridge is anticlinal and not synclinal, and the force crowding it up came from the north-west instead of south-east, as is the case everywhere else in the country. The relations of the granite to the schists is interesting. It is plain that the immense granitic area was eruptive, for at the boundary of the two enormous veins of granite had been injected into the schists. In the Saco Valley below the Notch, the granite occupies the lower area, and the schists upon the bordering ridges dip away from it in an anticlinal manner. The granite is the softest rock among the mountains, and therefore it is found chiefly in the valleys. These valleys have very abrupt sides, thus resembling the Yosemite valleys in California. The Professor could not agree with the theory of the California geologists, that the bottoms of these valleys had fallen out, he rather believed in the old-fashioned theory of denudation. The Coös group is a new one, it is not less than ten thousand feet in thickness, and is composed of a quartzite and limestone with staurolite slates and schists. It is characterized by the presence of silicates of alumina destitute of alkalies — and the minerals are staurolite, andalusite, and kyanite. Formations containing these minerals occur in New Hampshire, Vermont, Massachusetts, Canada, Nova Scotia and New Brunswick, and they were referred to this new group. The same had been described by Dr. Sterry Hunt a few weeks previous in the "American Journal of Science" as the Terranovan series, and some fossils of the Potsdam Period had been found in it in Nova Scotia. It would hence appear that this new system lies at the base of or below the Silurian, not far from the anciently supposed position of the *Taconic System*. That system had been the subject of violent discussion for twenty years, and he hoped that such results would not follow the proposal of the new *Coös Group*.

He next exhibited specimens of a new species of trilobite (*Acidaspis Whitfieldi*) from New Jersey, obtained from a boulder which was transported from New York by the glaciers. It came from the Marcellus slate. No other species of this genus had heretofore been found above the Schoharie grit.

Professor C. H. HITCHCOCK presented an argument to prove that a large portion of the North American Continent had been submerged beneath the ocean since the Drift Period. The proofs relied upon to maintain this position are the existence of twenty-seven species of maritime plants in the interior along the great lakes. These were specified by name and locality, extending up the Hudson River and Champlain valley and the

lakes of Ontario and Erie to Minnesota. He argued that these plants were originally introduced by natural emigration along an ancient estuary, and that many of them remain to the present day in consequence of the existence of conditions favorable to their preservation. He supposed that the plants about the salt springs in Northern New York were introduced in the same way. The pre-glacial flora has been completely destroyed by the intense cold, and while a new creation might explain the existence of salt water plants about the springs, it would not show why these marine plants could exist in the far interior. There should be a special fitness of species to conditions, in case the creation theory is invoked. He concluded that the continent must have been submerged two or three hundred feet lower than geologists had supposed, relying upon the ordinary arguments, and that the clays about Superior and Erie must have been of marine or estuary origin. It was quite unexpected that the present distribution of plants should throw so much light upon geological questions, and therefore it was urged that botanists should faithfully preserve the localities of all their specimens.

Professor T. STERRY HUNT said the presence of black iron sand upon many sea beaches has long been noticed both in Europe and America. Their origin is to be found in the crystalline rocks, from the disintegration of which these sands have been derived. The action of the waves, by virtue of the greater specific gravity of these sands, effects a process of concentration, so that considerable layers of nearly pure black sand are often found on shores exposed to wind and tide. These black sands vary in composition according to the localities, but as found on the coast of New England and the Gulf of St. Lawrence consist of magnetic oxyd of iron, with a large admixture of titaniferous iron ore, and more or less garnet, the purest specimens holding from thirty to fifty per cent. of magnetic grains. Such sands have long been employed as sources of iron in India, where they are directly converted in small furnaces into malleable iron. Early in the last century the considerable quantities of these sands found on our Atlantic coast attracted the attention of the colonists and of scientific men in England, and the Virginia sand-iron, as it was called, was the subject of many experiments. The first successful attempts at working it were, however, made in Killingworth, Conn., where the Rev. Jabez Elliot, grandson of the celebrated John Elliot, the apostle of the Indians, early turned his attention to the abundant black sands of the coast, and succeeded in treating them in a forge fire similar to the German forge or modern American bloomary fire. It appears from his account laid before the Royal Society of London in 1761, that he was then making iron blooms of fifty pounds weight from this ore, and that his son had already established a steel factory in Killingworth, when an act of the British Parliament forbade the manufacture of steel in the colonies. The London Society of Arts in 1761 awarded a medal to Mr. Elliot for his discovery. The working, however, was abandoned, and for a century no attempts were made in America to use these sands. Some four years

since the large quantities of them in the lower St. Lawrence attracted attention, and successful trials were made for their reduction in the bloomary fires of Northern New York, after which an establishment for working them was erected at Moisie in the Gulf of St. Lawrence, where, under the direction of skilled workmen from Lake Champlain, the treatment of these iron sands has been successfully carried on. These sand ores are remarkably free from both sulphur and phosphorus, and hence yield an iron of great purity and toughness. The working is effected in forges like those used on Lake Champlain, and presents no difficulties.

Prof. W. C. KERR remarked "On some points in the Stratigraphy and Surface Geology of North Carolina." The two long narrow belts (troughs) of coal-bearing triassic rocks in North Carolina, lying, nearly parallel, in a direction a little north of east, and separated by an elevated and rolling tract of metamorphic and granite rocks fifty to seventy-five miles wide, are found to constitute the fragmentary fringes of an eroded anticlinal, the one dipping north-west at an angle of 30° to 75°, the other south-east 10° to 35°. The material of this formation was furnished mainly by an ancient plateau or mountain chain lying eastward, between the mesozoic and the Atlantic, which "has left no sign" of its existence but this. I have found no trace of glacial action in North Carolina, even in the most elevated mountain plateaus, but abundance of Quaternary gravels, whose position is such as to negative the existence of glaciers in this latitude. Among these deposits occurs a remarkable peat bed, fifteen feet thick and about one hundred yards long, recently exposed in a railroad cut. Its position is very peculiar, at an elevation of more than one thousand feet above the sea, and near the top of a hill one hundred feet above the valley of the Catawba River (which is one mile distant), and twenty-five miles from the Blue Ridge. It is covered and protected by eight to ten feet of fluvial gravel and sand. It is peculiar also in its contents, being made up in considerable part of drift wood, and containing abundance of pine and hemlock cones (there being no hemlock forests nearer than the Blue Ridge) and other seeds, and also of charcoal, partially burned pine knots and charred logs.

Another peculiarity is that the peat, occupying the middle of the nearly vertical face of the cut (some eighty feet deep), and being exposed but one season, has put forth an abundant swamp vegetation, consisting of carex, juncus, and several species of swamp grass and weeds.

There are evidences in eastern North Carolina of considerable oscillations of sea level during the prehuman period (probably synchronous with the Champlain epoch). The accumulations of stratified gravels on the summits and slopes of the hills, at an elevation of more than three hundred feet above the present sea level, extending entirely across the State, at a distance of one hundred and twenty-five to one hundred and fifty miles from the coast, indicate the extent of this movement in one direction, while the minimum of elevation is indicated by the excavation of the channel of the Cape Fear River (e. g.) for more than thirty miles to a depth exceeding one hundred feet below the present tide level.

Professor W. C. KERR on the "Probable Origin of the South Carolina Phosphates." The physical circumstances of the deposition of these beds in their present situation, have been explained in a manner sufficiently probable by Professor Pratt of Charleston; but I have seen no suggestion which is at all adequate to account for the origin of the materials which compose them, — the elimination and accumulation of such enormous quantities of phosphate of lime in so peculiar a situation.

The recent discovery of the singular Brachiopod, *Lingula pyramidata*, in the shoals along the sounds of North and South Carolina furnish a solution of the mystery. This shell, it will be remembered, consists of *phosphate* instead of *carbonate* of lime. Its habitat is at the precise level of the Ashley River phosphates, and the shell being very fragile and left within the play of the tides in the shifting sand of the shoals, rapidly loses its form and furnishes only its solid material, to be agglomerated by some concretionary or other chemical or chemico-mechanical force into the nodular masses which are so peculiar to this formation.

THE MICROSCOPICAL SUBSECTION OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, which was initiated at the Salem meeting last year, was continued with renewed interest and increased numbers at the Troy meeting this summer, and promises to be a permanent and useful division of the Association. Under the Constitution, as amended this year, this department is removed from Section B (Natural History), and recognized as Subsection C of Section A (Mathematics and Physics). This arrangement, though somewhat confusing, is probably the most convenient that could have been made; microscopy proper, the science of the instrument, belonging strictly to mathematics and physics — but microscopy applied, the use of the instrument, being chiefly a department of Natural History. To avoid confusion at this point, authors of Natural History papers designed for this department should make a memorandum to that effect upon their MSS., as a request to the standing committee to assign them to Section A instead of Section B.

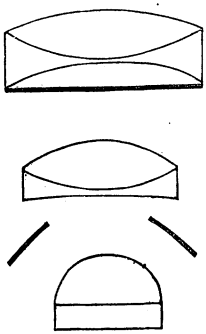
Professor S. S. HALDEMAN, of Columbia, Pennsylvania, was elected *Permanent Chairman* this year; and Dr. R. H. WARD, of Troy, N. Y., *Secretary*.

Although this subsection, having been recently formed, has necessarily been much occupied with the details of its own organization, it has already done much work and contributed some valuable papers, among which were the following, of which abstracts are published elsewhere: "On a new form of Binocular Microscope," by President F. A. P. Barnard, of Columbia College, N. Y., describing elaborately a newly contrived instrument in which the light is separated into two pencils by double refraction, and which cannot fail to be a valuable addition to the resources of the working microscopist; and "on the Illumination of Binocular Microscopes," by Dr. R. H. Ward, of Troy, suggesting convenient means of regulating illumination in the naturalist's every day work with the microscope, and urging that professional microscopists make their influence

more distinctly felt in regard to the lower classes of instruments that are furnished to beginners, and particularly in regard to popularizing the Binocular Microscope.

In exhibiting photographs by Dr. Maddox of the Podura scale, President Barnard gave an exhaustive review of the discussion in regard to the structure of the scale. The traditional "note of exclamation," or goose-quill markings are unlike those of any other known scale, and many naturalists are anxious, on grounds of analogy, to get rid of them. Mr. Beck argued that these marks represented parallel lines on different sides of the scale, crossing each other at an acute angle, and necessarily imperfectly focussed; some observers have attributed them to corrugations or folded ridges of the upper and lower membranes of the scale; and Mr. Pigott, with his aplanatic searcher, and others have seemed to resolve them into bead-like rows of spherules, between two membranes. The use of reflected light to determine these points is very desirable, but difficult with sufficiently high powers. Professor Smith, of Kenyon College, proposed to make the objective its own illuminator. Others have replaced the mirror he placed behind the lenses by a plate of glass or a prism; but all these means give a glare of light by reflection from the surfaces of the lenses. The speaker had proposed a concave mirror behind the outer pair, an internal Lieberkuhn (fig. 100) which works exceedingly well with medium powers, say one-third or one-fourth inch; but there is not room for its insertion in high powers. As compared with Tolles' prism, which is similarly situated (above the front pair), it gives more light, and illuminates from any part or all parts of the circumference at will; on the other hand it is less easily applied, requiring the front lens to be mounted in glass instead of brass, and it is inapplicable to large opaque objects. The beaded appearance has not yet been satisfactorily seen by reflected light; nor is it well shown in the photographs where the wedge-shaped dashes seem rather marked by crosslines or partial interruptions. The speaker evidently doubted the accuracy of the exclamation points, but was not yet ready to accept the beads. Appearances best seen by pushing an objective far beyond its ordinary power were received with general distrust.

Fig. 100.



In the discussion which followed the reading of this paper, Dr. Ward remarked that the production of a beaded appearance, as a purely optical effect, should be considered no longer doubtful, but rather an occasional accident to persons using high powers. As an extreme instance, in the case of a coarse and familiar structure, he related that while experimenting upon an elater of *Marchantia polymorpha*, that beautiful double spiral

was "resolved" into three rows of "beads" or "hemispheres," perfectly distinct and unmistakable, which occupied, of course, the position of the middle and edges of the spiral. They were illuminated by parallel light, very oblique, under a 1-15 objective of 175° worked at a power of 3,000 diameters.

Mr. E. Bicknell, of the Museum of Comparative Zoology at Cambridge, Mass., exhibited some diatoms recently thrown up by the sea at Marblehead, Mass. The deposit first found belonged to brackish water, as indicated by the nature of the diatoms and the presence of fruit of the *Characeæ*. The second deposit occurred about a mile from the first, and was purely of fresh-water origin; consisting of peat with fresh-water diatoms, — *Pinnularia*, *Stauroneis*, *Navicula rhomboides*, *N. serians*, etc. These deposits were thrown up by a severe storm on the 31st of March last, and are believed to be the first fresh-water or brackish deposits known to exist under the present ocean. They seem to be conclusive proof of the recent encroachments of the ocean upon the shore-line in that vicinity.

The Test Plate of Nobert, who has now "gone to the war," and Dr. Woodward's photographs of the same, were exhibited by Dr. Ward, chiefly in the interest of that part of the audience who were not professional microscopists, and might be unfamiliar with these wonderful works of human art. Until a year or two ago the finest lines had never been seen, even by the maker of them; now they have been seen by many persons, and have been photographed. He was now satisfied, for the first time, after hearing Mr. Bicknell's description, that the Boston microscopists had seen the *genuine* lines with powers of only five or six hundred diameters. In regard to the use of photography as a test of structure under high powers and difficult circumstances, we may learn a lesson from the broad bands of light and shade in the photograph of the coarser lines, which manifestly have no resemblance to the appearance of scratches on glass as seen under suitable powers.

Dr. Ward had also been investigating the effect of seeing two planes of the object at the same time with the Wenham's Binocular. The eye-pieces being practically not equidistant from the objective, the corresponding conjugate foci below do not coincide. Some microscopists have attributed much of the stereoscopic effect to this fact, which, however, does not seem to contribute perceptibly (except in the lowest powers, where the angular stereoscopic effect is necessarily very small, and where this difference of planes is most considerable), either to the stereoscopic effect, or to the increased distinctness of definition above and below the plane of most perfect vision.

An abundance of instruments were furnished by members to illustrate their discussions, or for the general work of the subsection. The first class stands were mostly of the make of Powell and Leland, and Beck, and Crouch, of London, of Nachet of Paris, and of Zentmeyer in this country. The "Jackson" model of stand, with a curved arm, seems to be

growing in favor here; and it is to be hoped that those makers who have heretofore made only one style of stand will soon offer both; so that buyers can choose their style of stand irrespective of their choice of makers. In objectives and accessories Tolles, Wales, Zentmeyer, Grunow, Spencer, Miller, and some other American makers were represented; also Ross, Beck, Powell and Leland, Crouch, Collins, Murray and Heath, Swift and Browning, of London; Nachèt and Hartnack, of Paris; and Gundlach of Berlin. Very low power objectives, 3 and 4-inch, were deservedly popular. The use of immersion objectives for all high powers seemed to be assumed by all members as a settled question. Few members, on the other hand, fall into the present fashion of high power objectives,—preferring to use lenses of 1-15 or 1-16, and downward, and gain greater amplification by other means than by reducing the nominal focus of the objective.

Dr. Josiah Curtis exhibited a micro-telescope, or microscope and telescope combined, made to his order by Tolles. It is an ordinary Cutter's clinical microscope, fitted with an extra tube carrying an object glass of one inch linear aperture and six inch focus, to which objective the compound microscope acts as an erecting eye-piece. Furnished with a proper support this makes an admirable pocket telescope, defining well at powers of forty or fifty diameters.

Mr. Tolles had mounted a 2 1-2-inch lens with the society screw on each side of the shoulder, so that it can either be screwed on in the usual position, or passed up into the body of the instrument and fastened there, giving, by approaching the eye-piece, about the power of a 4-inch lens at the usual distance. Microscopists have been accustomed to gain a lower power than could be focussed by their rack, by screwing a low objective into the drawtube and focussing upon the object through the empty nose-piece. The new plan of a reversible mounting is more convenient, and is applicable to instruments that have no draw-tube; unfortunately it cannot be used with the ordinary Binoculars. The lens, though of second class, was very good.

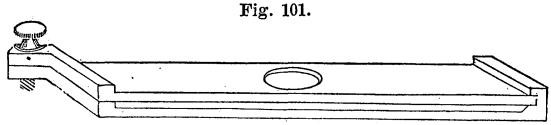
Mr. Tolles has also arranged a 4-inch objective in which a short working focus is obtained by a reducing lens in the rear. This reducing lens, for convenience, is mounted in a sliding tube, and gives when pushed in a fair 3-inch power. As a 4-inch the combination is extremely good.

Mr. Bicknell applies this expedient to ordinary objectives; placing in the draw-tube, instead of the concave amplifier sometimes used, an achromatic convex lens as a reducer, with which an extremely low power can be obtained with good definition, flat field, and working focus not inconveniently long. A 4 1-2 or 5-inch lens (solar focus) may be used. A low objective of two combinations may be divided, using one part as an objective, and placing the other in the draw-tube.

Dr. Ward had contrived a "clinical" compressor for use with the microscope of the same name. The clinical microscope is very convenient for examining mounted specimens, which is exactly what it is not wanted

for — except by teachers. He had used it for years in teaching, but not much as a "clinical." A glass slide to hold the object, with a thin cover held on by capillary attraction, is well for once, but does not satisfy a busy man. It applies to too limited a range of objects; and the cover is inconvenient to carry, awkward to handle, and easy to break. He had used Wenham's compressor until lately, but that is inconvenient under the springs of the "clinical" stage. The new compressor, figured below, is simple (and therefore inexpensive) and can be used with great facility both for clinical and class use, and for much of the ordinary work of the microscopist. It is reversible, except upon a large stage, in which case it would require a few pins to serve as legs. The want of parallelism is less than in most compressors, and is not inconvenient in clinical use. The two brass plates separate entirely for arranging the object or cleaning the glass. The upper plate fits into a notch filed in a ledge at the left of the lower, the centering of the two plates being secured by a pin through the lower and a notch in the upper. The screw which attaches them at the right is permanently fastened in the upper plate by a groove and a pin. It has a coarse thread, which may be cut double to screw out more rapidly, or the thread may be reversed near the centre so that it will at the same time raise the upper and depress the lower plate. Should a steadier motion be required, a spring may be riveted upon one plate to press against the other. The apparatus is adjusted for a glass of 1-20

Fig. 101.



Ward's Clinical Compressor.

inch below the object and 1-125 above, cemented upon the inner surface of the brass plates. This is strong enough to carry in the pocket safely; it can also be used with the parabolic illuminator, or with any objective or achromatic condenser except those of large angular aperture. Should thin glass be required for any purpose, a glass or tin cell of sufficient thickness to make up the difference should be cemented on one of the plates, or both if necessary, and the thin glass fastened upon the rim thus formed. Should no cell of suitable thickness be at hand, select a glass cover of the required thickness, fasten it with marine glue on one of the plates, punch out with a file the part corresponding to the opening in the plate, and then fasten the thin glass with Canada balsam upon this extemporized rim.

Mr. E. B. Benjamin, of New York, exhibited a microscope by Gundlach of Berlin. This was a small and cheap instrument, according to the English and American standard, but really admirable for its neatness of design and finish, and its general excellence of performance.

Beck's "popular" microscopes, binocular, were exhibited by Mr. C. E.

Hanaman and others. They have already vindicated their name in this country as well as at home.

Mr. Charles Stodder, of the Boston Optical Works, exhibited Cutter's clinical microscopes, and Tolles' students' microscopes, of various degrees of completeness and cost. These instruments are already too well known in this country to require comment. That they are thoroughly good of their kind is what is claimed for them, and is the least that can be said of them. In buying a students' microscope, however, the beginner should always be advised, in the writer's judgment, to have it furnished with a first class 1-inch objective or something very near it. So much of his early work is, or ought to be, done with this power, and his success as well as pleasure depends so much upon its light and definition, that it ought to be the last point economized upon. The sliding stage upon some of these instruments would seem to be easily convertible, for those who wish it, into a White's lever stage.

Mr. F. Miller, of New York, exhibited a good students' microscope of very low cost. It is chiefly notable for its large body, which admits a large eye-piece and gives a good field. Mr. Miller also exhibited excellent illuminating prisms and various accessories and objects, including Möller's beautiful type plates.

Crouch's educational microscope had a larger body than even Miller's, admitting the use of the same eye-pieces as the first class stands. The advantage of this is enormous in the case of the lowest eye-piece.

Blankley's neat and convenient tank microscope, made by Swift of London, was exhibited by Dr. Ward. Also Murray and Heath's "sea-side."

Of the general business of the subsection the most important was the appointment of a committee to report in relation to uniform standards in the power of objectives, eye-pieces, etc. President F. A. P. Barnard of New York, Mr. E. Bicknell of Cambridge, Mass., Dr. R. H. Ward of Troy, N. Y., Professor C. E. Pickering of Boston, Professor O. N. Rood of New York, and Dr. Josiah Curtis of Boston, constitute this committee.

ANSWERS TO CORRESPONDENTS.

J. J. H. G.—The Humming Bird you describe is the male of the common Ruby-throated Humming Bird (*Trochilus rubris* L.). The female and the young are without the brilliant scarlet color on the throat seen in the males. After midsummer the scarlet throated individuals are far less numerous thon the others. There is but one species of Humming Bird in the Northern States.—J. A. A

J. M. J., Halifax.—We will endeavor to name the collection of marine invertebrates for you.

S. A. W., Bucks Co., Pa.—Your fern is *Osmunda regalis*.—J. L. R.

S. L., Freehold, N. J.—The caterpiller is that of *Pieris rapæ* Shrank, which was introduced from England to Quebec in 1856 or 1857, and is stated to destroy annually $240,000 worth of cabbages in the neighborhood of that city. It thence spread into New England, and is now common about New York and Philadelphia. It feeds concealed on the heart of the cabbage, while the two other species of Pieris, *P. Protodice* and *P. oleracea*, feed on the outer leaves.

The other specimens were the pupæ of a species of Syrphus fly, which feeds on the plant lice, so abundant on the cabbage in the autumn. The Syrphus fly is of course very beneficial.